

MK 14 MOD 2 Corrective Action Status / Evaluation Results to Date 27 June 2012
Reference Task List from POA&M Scope/Mount/Precision/Function Issues w/ details:

Confirm Scope Rail to Ring Interface Suitable:

Check that the current (Weaver / Leupold pattern) scope base is suitable for the NF ULT Rings. This is done by visual inspection (gap in between clamp bar and ring when installed) and measurement (lug to cross slot fit). Also, request verification of rail size fit range for their rings.

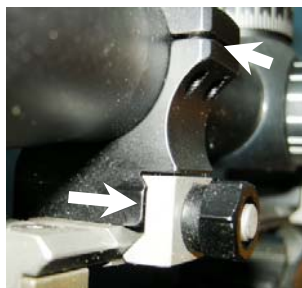
Results: Desired contact surfaces and clamp bar gaps were confirmed on 6 each MK 14 MOD 2 Rifles. Ring contacts confirmed are lower 45 degree angled surface on one side of rail, full top rail surface and lower 45 degree angled surface on opposite side of rail (contact with lower angled portion of movable jaw / clamp bar). Clamp Bar gap was good (approx. 0.015" min.) – plenty of clearance / movement range remaining when installed. Rail size is very consistent (0.001" total tolerance seen in samples). Ring recoil lug thickness was also measured as was rail recoil lug slot width – there were no potential interferences found. However, the forward slot of the rail does typically allow the forward attachment screw head to enter slightly into the slot area reducing its effective width to within as little as 0.002" of the ring lug width (this slot is not used for initial optic installation).

Ring Cap/Clamp Bar Gap was determined for 6 rifles based on how many sheets of 0.0035" thick paper could be inserted in gaps - Scope Rail slot widths were also measured as were rail widths:

Rifle SN	Min Ring Cap Gap	Max Ring Cap Gap	Ring Lug Thickness (both rings)	Mount Base Slot Width (both in use)	Min Width Front Slot at Mount Screw	Rail Width	Clamp Bar Gaps (1 ring)
-0917	5=.0175"	8=.028"	.138"/.139"	.159"/.161"	.144"	.831"	5=.0175"
-569	6=.021"	7=.0245"	.139"/.139"	.162"/.165"	.148"	.831"	4=.014"
-4222	3=.0105"	6=.021"	.140"/.140"	.161"/.161"	.142"	.831"	5=.0175"
-0421	8=.028"	10=.035"	.137"/.137"	.160"/.162"	.144"	.831"	5=.0175"
-4291	6=.021"	10=.035"	.136"/.138"	.163"/.164"	.142"	.831"	5=.0175"
-5080	7=.0245"	10=.035"	.138"/.139"	.161"/.163"	.142"	.831"	5=.0175"



Crane Design Mount with Optic Installed



Ring Gaps



Ring Recoil Lug



Top View of Crane Mount Rail

(note that top mount screw head can extend into front slot reducing its effective width)

Confirm Fit of Rings to Scope Tube & Screw Torque:

Confirm that 20-25 inch-lbs torque is acceptable. Also determine typical torque applied using short end of Torx wrench (and confirm that torque is also OK) on ring cap screws. Also confirm with NF what is OK.

Results: (b)(6) the Govt. NF representative was contacted and verified that they recommend 15 to 25 inch-lbs of torque for the ring cap screws and that excessive torque beyond that would not affect the optic but only risk damage to the screws/rings. Six each MK 14 MOD 2 Rifles had all their ring cap gaps examined and were found to be of proper fit (avg. gap approx. 0.020 inches). See results in prior Table.

Confirm Scope Zero Stop Function:

To be done both at range and in lab on collimator – sampling of the scopes to be used, as well as focus on the returned scopes with noted issues. Get w (b)(6) and NF rep.

Results: The 2 scopes that appeared to have zero stop issues have not yet been received/examined. However, a general zero stop analysis showed that too much or too little torque on the zero stop screws as well as the scope knob screws could have detrimental effects potentially allowing some slippage during adjustment with too little torque(noticed by lack of tactile clicks at consistent intervals) or causing damage due to excessive torque.



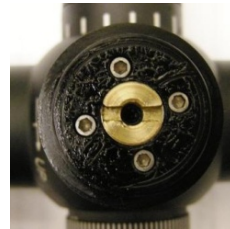
Bottomed against stop



Some Elevation



More Elevation



4 Screws to Secure Stop

Confirm Scope Tracking:

To be done both at range and in lab on collimator – sampling of the scopes to be used, as well as focus on the returned scopes with noted issues. Get w (b)(6) and NF rep.

Results: After further discussions with the lead instructor it is not believed that tracking has been an issue.

Induct (and Evaluate) some M14 SSR's retuned in last year:

Call in these rifles which need to be inducted anyway for overhaul into MK 14 MOD 2 configuration. Look for weapons tagged with function issues for focus testing / inspection.

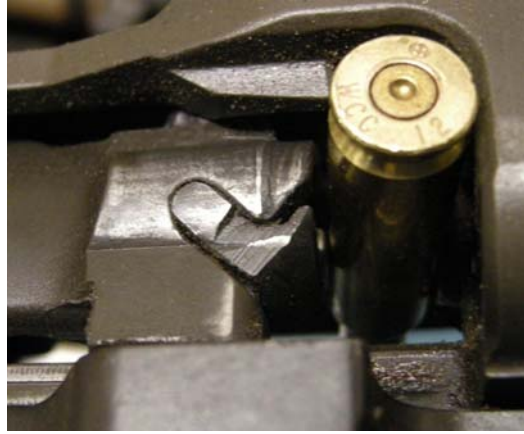
Results: 16 of the rifles more recently returned under the -8975 NSN were inducted and brought to the SWAF. Most of those were evaluated in some manner in an attempt to help determine factors involved in the potential loss of the extractor during firing. The rifles included a mix of the older M14 Sniper Kit or Sniper Security Rifles (Black Stock) and the Grey and Tan Stocked M14 SSR configurations. It was noted that several rifles had modified extractors (all at the top to apparently eliminate potential barrel (shroud) interference. One of the current tan stocked SSR's even had this modification (-7198). All these rifles turned in with modified extractors were test fired with new unmodified extractors and did not have any functional issues (related to the extractor – there were two of the magazine used that were found to be at fault for the failure that did occur – fail to lock back after last shot and failure to pick up next round). There was also no apparent correlation between tight headspace (at minimum 1.630") and any extractor issues.



Bolt from M14 SSR -4360
Showing Modified Extractor



Modified Extractor in Bolt vs. New Condition



Modified Extractor in Old Black Stocked "M14 Sniper Kit" (SN – 0488)

Note: Barrel Shroud Cut Angle in first image is similar to that of the two MOD 2 rifles with issues



Recently Returned (for conversion to MOD 2) M14 SSR -7198 which has Modified Extractor
New unmodified extractor was installed and there were no issues (even with minimum length X spring/plunger)



M14 SSR -1147 (older gray stocked with rear lug)
Extractor shows Barrel Contact – no Functional Issues

Induct MOD 2 Rifles/Scopes Returned by MESHG-2:

Call in the MK14 MOD2 weapons returned from the EDM class at MESHG-2 for evaluation / corrective action.

Results: Rifles have not yet been received. 5 rifles are being returned – 1 for kicking out extractor twice, 2 for scope zero stop issues, 1 for broken trigger guard lock tab, 1 for broken (by user) forward scope mount rail screw.

Examine/Test M14 SSRs and MK 14 MOD 2's to determine Extr. Loss Cause:

Inspect and test (live fire in 2521 ranges) MK14 MOD2 rifles returned from the EDM class at MESHG-2 to determine the cause of the extractor issues. Fire 80-100 rounds through suspect weapons. Isolate cause of issue with each weapon which displays tendency to lose extractor.

Results: This evaluation of the one MOD 2 rifle w/extractor issue will take place at "A" ranges once it is available.

Determine Solution to Extractor Loss:

Establish a corrective action to fix and eliminate the extractor loss issue. Focus areas are clearance between extractor and barrel shroud area for complete bolt cycle as well as extractor to barrel clearance in recessed area at chamber.

Results: Live fired tests as well as research and discussions with SME's have determined that there is typically more than a single risk factor present when extractors are ejected during firing. However, the key characteristic in common for the two MK 14 MOD 2 rifles on hand that demonstrated the dislodged/lost extractor phenomenon was that both had barrels with the same barrel shroud cut/profile which created more extractor interference than is typical. These barrels were not marked like typical Springfield Armory Barrels and appear to have a slightly different profile. They were most likely procured from a different vendor. Extractor Loss Contributing Factors emphasized in an old periodical military publication for users were: weak extractor spring, bent plunger (detent shaft), and worn extractor shaft. See below excerpts. There are several areas of the bolt assembly where tolerance stacking could also be a factor.

Discussions with SME's revealed that there have been issues with this in the past related to specific lots/batches of extractors as well as weapon configurations being built. Barrel vendors, and therefore machined barrel configuration detail differences, are most likely key factors. Also, as a rifle is fired the interference is reduced due to battering/peening of the barrel shroud contact area so that the likelihood of the issue continuing is reduced. Some of the supposedly A condition Extractors and Extractor Spring/Plunger assemblies called in for this build do not appear "as new". Verified new spring/plunger assemblies will only be used in the future. New extractors can vary in total height which relates to stem/shaft length (longer has more risk of protruding below bolt body and getting pushed up by ammunition in the magazine). They also have a range of depth in their detent dimples (tolerance range found at around 0.014"). Shallower dimples will not tend to allow for the positive retention that deeper dimple do. The head of the Plunger that seats in the dimple has 0.010" of allowed thickness tolerance which impacts retention (thicker head compresses spring more for better hold).



Does the extractor have a bad habit? Like jumping out of the bolt. That's usually caused by a worn extractor shaft and a weak spring and plunger.

Another thing about the extractor plunger... the round bottom head of the plunger wants to seat in the recess of the extractor. And if the plunger is bent, it'll foul up the movement of the spring. And you'll have extractor troubles. Something else... don't forget to keep a light coat of oil on the plunger.



Spring Length and Plunger Head Thickness Tolerance Are Factors Impacting Extractor Retention (Wolff Aftermarket Spring on right)



Notice End of Extractor Stem/Post is below Bolt Body Profile – Desirable Fit Condition

Nominal Free Length of Extractor Spring per Drawing 6008886 is 0.480"
(a typical new spring measured 0.091" by itself and 0.566 inches as an assembly with the Plunger)

Establish non-firing method to verify extractor is secure:

Determine a suitable method of checking / inspecting / gauging the system to negate the loss of extractor. Slow hand cycling of the bolt and cycling of Dummy Rounds will show the potential for extractor to barrel interference. The interference occurs (or is at its worst) as the extractor pivots to get over the rim of the case.

Results: One method that could be used to determine the relative security of the extractor within the bolt assembly is to develop a fixture to support an assembled bolt for use with a spring tester which could determine the load applied to an extractor stem (applied from bottom of bolt) which will eject it from the bolt body (could also check installation force). This however will not in itself tell us whether an extractor is likely to stay put. Two key factors appear to be whether the extractor post/stem protrudes from the bottom of the bolt body (allowing cartridge case walls to press up on it) and the extent of any interference between the extractor and the barrel (specifically its rearmost top shroud area). One thing this test would indicate is how well the extractor "detent dimple", plunger head, and spring work together within a particular bolt to secure the extractor. The ejector could be removed for this testing since it would be compressed into the bolt face and not add resistance at the time when the extractor is most vulnerable to ejection.

Confirm Precision and Function of 20 Rifles for July EDM Course: (600 yds SWAF)

Validate the precision of "A" condition assets at 600 yards (firing five (5) five (5) shot groups for precision— fire at least forty rounds from two (2) magazines per rifle).

Results: Per discussions with (b)(6) he can only accommodate 15 rifles at this time (has 11-12 students and instructors already have rifles available). It was decided then to validate precision potential of 15 rifles (as well as reliability) in order to have them sent out for the July EDM course. The 15 rifles were tested and found to be suitable (each fired no less than two full magazines of MK 316 ammunition reliably and also produced 2 each groups at or below the 1.5 MOA goal at 575 yards). There were additional MK 14's used in testing as well. One of these did kick it's extractor out twice and also failed to completely chamber a round once (due apparently to extractor to barrel interference). One of the extra MOD 2 Rifles available had kicked out extractors twice during qualification (they were changed out each time) and it had already then been qualified. It was fired some more with no issues but did appear to have the same exact configuration barrel as was used on another extra rifle that had not yet been qualified and did kick out it's extractor during testing (twice plus one fail to chamber due to it interfering with the barrel).

575 yards (Electronic Targeting System Data) Ammo: MK 316 MOD 0 (AB39)			18-Jun-12	
MK 14 MOD 2 Precision Potential Confirmation Test Results				
All 5 Shot Groups				
Rifle SN	Group 1 Extreme Spread	Group 1 MOA	Group 2 Extreme Spread	Group 2 MOA
	inches	(ES angle)	inches	(ES angle)
1182768	5.5	0.92	7.1	1.18
174394	4.2	0.70	5.9	0.98
883518	6	1.00	6.0	1.00
474196	8.4	1.40	8.8	1.47
362801	6.4	1.07	8.2	1.37
1302335	7.6	1.27	8.0	1.33
1117924	7.1	1.18	8.3	1.38
586686	5.9	0.98	6.6	1.10
1341415	7.7	1.28	8.3	1.38
872576	5.8	0.97	8.9	1.48
1295968	6.3	1.05	7.3	1.22
618981	6.3	1.05	6.9	1.15
1391393	6.8	1.13	7.0	1.17
1357562	7.4	1.23	8.3	1.38
562304	5.7	0.95	6.1	1.02
	Group 1 Avg MOA	1.08	Group2 Avg MOA	1.24

Notes: At 575 yds - 6 inches is 1 MOA and 9 inches is 1.5 MOA, All groups fired without "tuning" screw barrel contact.

Barrel Configuration Differences Found to be Common in the Two Rifles Which had Extractor Issues (vs. known SAI)



Typical SAI (Springfield) Barrel Marking



Springfield Barrel Front Section Profile



Standard Barrel Shroud Area (SAI) SN - 4360
(notice slight burr at top edge from minor extractor contact and large edge break / radius - see arrows)



Notice Brass Color on
Extractor Indicating
Contact - Not Good

MOD 2 -4222 which Qualified after two changes of extractor, marking is from barrel installer/builder at Crane)
(most likely repeated firing peened interference and reduced risk of continued extractor kick out problems)



MOD 2 - SN - 4222 Barrel Shroud Area

Notice Severe Peening and Different Cut Configuration as well as less edge break/radius than standard SAI Barrel
This configuration leave more material for extractor interference both due to the different cut angle and from the minimal edge break (chamber along the rear inner edge of the shroud). Arrows indicate peening due to interference.

Second Rifle with Extractor Issues and Same Barrel Configuration as Other Rifle with Issues



MOD 2 -0917 which had already been qualified – had extractor come out of proper engagement twice during additional function/accuracy testing and also caused a failure to chamber due to interference with the barrel shroud



Notice longer section of 1" dia. Barrel Area for Op Rod Guide vs. SAI Standard Barrel (MOD 2 -0917)



Barrel Profile near Gas Cylinder (MOD 2 -0917)



MOD 2 -0917 after first extractor event



MOD 2 -0917 after second extractor event



MOD 2 -0917 in between extractor events – Failure to Chamber due to extractor interference with Barrel Shroud (as case head is forcing extractor out/open to snap over rim it contacted the shroud binding the bolt before it could rotate into battery – extractor face against base/rim of cartridge)



Chamber Barrel Shroud View of -0917
which has the same barrel config as -4222 above



Typical M14 Bolt Head Configuration



Extractor that came disengaged twice (-0917) and also caused a stoppage without becoming disengaged
Its stem/ measured 0.695" (on the long side) and it
Did protrude below the bolt body. The detent dimple
Depth (as measured for comparative purposes – not true depth)
Was at 0.016" which is toward the shallower side of the range.
Arrows indicate barrel contact point

Collect up All Op/Maint. Details for Inclusion in MOD 2 Docs:

Record any changes and save for inclusion in MK 14 MOD 2 Documentation (OM/TRS, etc).

Results: The powerpoint brief used during the instruction of the EDM Course was provided and has been upgraded with improvements to include photos and any agreed updates to the instruction details. This document can be revised as necessary to reflect the currently known best practices / information.

Turn in 20 Rifles for Shipment to MESHG-2:

Prepare 20 MK14 MOD2 systems ready and turned in for shipment to MESHG -2 for use in the 30 June – 13 July Expeditionary Designated Marksman Course at (b)(5)

Results: The turn in of the 15 rifles is no longer on a critical timeline due to a miscommunication where rifles ended up being ordered from the Norfolk end when the intent was to ship from the Crane end when the rifles were ready. A condition rifles already in stock at "B" had already shipped a week or two prior to this testing for support of the July Course. Since we are planning to visit (b)(5) during this EDM Course, we will be on hand to examine the rifles as well as witness or inspect soon after any issues that may occur (and potentially correct them). Also, there are at least 3 spare rifles available based on anticipated student count. The 15 rifles that were verified at 575 yards for precision capability and were also confirmed reliable (2 additional magazines minimum of MK 316 MOD 0) are ready for turn in once cleaned and repacked. The remaining rifles which have been qualified will be inspected once a determination is made as to the process and will then be turned in and made available for issue as well.